Inter-Vehicular Communications: Quo vadis?

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Traffic Accident Statistics

How/Where?

- Pedestrians: 9%
- Rear-end: 32%
- Misc.: 14%
- R/L Turns: 26%
- Head-on Collisions: 9%

Why?

- Unawareness: 70%
- Operation miss
- Misjudgment

Vehicular communications is expected to remove up to 80% of the “unawareness” component.
How does it work?

• V2V communications as of today
  – Broadcast only
  – It is like yelling what you are doing whether it is of interest or not to people around you - 10 times/second
  – Receivers assess other vehicles’ “threat levels”

  – Reliability measure (Japan case)
    • 80% correct reception at single attempt
    • 96 % in two attempts
Is it ready to deploy?

• Inclined to say “yes, almost ready” – technically
However,

• Non-mandated solutions must show immediate benefit in order to be accepted by the consumers
  – Seat belts → Airbags → IVC ?
  – Retrofit and aftermarket devices can accelerate deployment

• Ongoing challenges regarding privacy and security
  – Especially consumers in the US are very “privacy-conscious”
Scalability

- CSMA/CA à la highway
An unexpected role for vehicles

• Vehicles acting as part of “network” infrastructure
• Vehicles carrying “offloaded” data on behalf of infrastructure
  – Non-real time
  – Especially during disrupted/disconnected situations
• Implications for safety-critical vehicular applications need to be dealt carefully
What could be the next?

• If done correctly, V2V/V2I might be a key enabling technology towards autonomous - automated driving
Automated Driving

- 360-degree, real time situational awareness required
- Number of radars, lidars, sensors, cameras in the vehicle increases
- Direct communication with other vehicles and with the infrastructure can significantly augment the sensing capability of a single vehicle
  - Not only the states of other vehicles, but also environmental information needs to be exchanged
Automated Driving

• Google’s self-driving car gathers 750 megabytes of sensor data per second
  – Not all of that needs to be transmitted
  – But how much of it needs to be shared with neighboring vehicles?
    analysis of communications capacity needs

Credit: Google
Summary

- Cellular world is now moving to 5G
- Vehicular Communications is getting ready for 1G
- Deployment of the first generation of safety systems will happen soon
- We will only understand and acknowledge the problems by then
- Things will become more interesting for the research community towards the creation of the second and further generations of vehicular networking